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ABSTRACT

This report is the result of a pilot program to seek out ways for developing an educational institution's transportation flow. Techniques and resulting statistics are discussed. Suggestions for additional uses of the information obtained are indicated. (Author)

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UNIVERSITY OF BRIDGEPORT

COLLEGE OF ENGINEERING

BRIDGEPORT, CONNECTICUT 06602

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AN ORIGIN AND DESTINATION TRAFFIC SURVEY AND ANALYSIS FOR HECUS UNIVERSITIES

Submitted to

CONCORD Project of HECUS

by

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HE 005 773

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INTRODUCTION

The national transportation problem has taken on a new perspective within the past decade. It is now realized that transportation cannot be effectively handled through the use of one particular mode (1, 2, 3)*. In the late 1950's recognition developed that long-standing highway programs were creating an imbalance in urban mobility. Thus, through Congressional appropriations state and local municipalities are able to overcome many of their major transportation concerns and can look optimistically toward the future. Solutions to these complex problems obviously requires a great deal of planning and consequently the accummulation of data related to the movement of specific groups of people.

The last point mentioned deserves further attention. The professional literature contains several studies in recent years describing travel by elderly (4, 5, 6) and minority (7, 8) groups, and how transportation systems specially suited to serve the above groups, were planned. One group of distinctive travelers which have received very little attention, but which may be important to certain regions of a given state, is the college attending student. In particular, the Fairfield County region contains HECUS institutions that comprise a significant portion of the community's travel considerations for educational or cultural purposes.

This report describes a pilot study carried out at the University of Bridgeport in which travel to and from the University is considered. A special interest is directed toward mode of travel, time on campus, ori-

* Numerals in parenthesis refer to corresponding items found in References.

gin, and destination after leaving the campus. Since this is a pilot project, consideration of efficient techniques for obtaining the relevant data became extremely important.

Several benefits which are derived from this study can also be applied to other HECUS institutions. They are: (1). It is possible to incorporate information obtained into Bridgeport Transit District's TOPICS program to improve the capacity and safety characteristics of existing streets; (2). Major transportation corridors of travel to particular institutions can be identified; (3). The University's transportation problems are provided with information which facilitates more directed solutions; and (4). Long range guidance in fitting the academic community into the complex urban transportation system, within and surrounding the institutions, can be accomplished.

The report is separated into two main parts. First, a procedures section will elaborate on the approach followed for obtaining special events and university population transportation data. A second section relates to results of the survey. A computer program has been developed to analyse all data obtained. It became possible, with this program, to compare different size samples from the initial sample, and thus see if the total number of individuals involved in the survey could be reduced. Furthermore, it was possible to establish some rationale toward a randomly selected sample.

PROCEDURE

The study's main consideration has been based upon transit movement relative to the student body, faculty and staff at the University of Bridgeport, and therefore a great deal of effort went into planning and development of this particular portion of the survey. In addition though, a set of surveys were carried out to evaluate movement of participants to and from certain special events. Consequently, this section will describe the technique pertaining to each separate situation.

Special Events - Two special events were surveyed each of which took place at the Arnold Bernhard Arts-Humanities Center.

A questionnaire (Fig. 1(a)) has been designed (9) to determine movement to and from the events and as such certain questions became paramount e. g. 1). What percentage really came to the event as a prime purpose? 2). What was the mode of travel; and finally 3). Where did the participants go after the event? Engineering undergraduate students helped revise the questionnaire's form several times pointing out initial shortcomings e.g. 1). The final questionnaire used all capital lettering; 2). It allowed more space between questions and 3). The word home in question four was replaced by residence. Figure 2 is a map of Bridgeport divided into nine areas thus allowing a convenient method to identify the City's area contributing the greatest number of participants to each event. Figure 2 also was incorporated into the main survey of the University.

The first event surveyed came on May 18, 1972. This program con-

UNIVERSITY OF BRIDGEPORT

TRAFFIC STUDY

SPRING 1972

TO: ALL PARTICIPANTS

THIS QUESTIONNAIRE IS BEING DISTRIBUTED AS PART OF A TRAFFIC STUDY BEING CONDUCTED FOR THE CONNECTICUT CONSORTIUM FOR RESEARCH DEVELOPMENT. YOUR COOPERATION IN ANSWERING THESE QUESTIONS IS ESSENTIAL TO THE SUCCESS OF THIS PROJECT. YOU NEED NOT GIVE YOUR NAME.

1. WOULD YOU BE ON CAMPUS AT THE TIME OF THIS EVENT FOR ANY OTHER REASON?

   YES_____ NO_____

2. HOW DID YOU TRAVEL TO THE EVENT?
   (PLEASE CHECK BEST ANSWER)

   1) AUTO.....
   2) CHARTERED BUS.....
   3) PUBLIC BUS.....
   4) WALKED.....
   5) OTHER, (PLEASE DESCRIBE)_____

3. IF YOU CAME BY AUTO PLEASE ANSWER THE FOLLOWING:

   a) HOW MANY WERE IN YOUR TRAVELING PARTY?_____

   b) ARE YOU OR ANY ONE IN YOUR PARTY:
      (1) FACULTY MEMBER_____
      (2) STAFF MEMBER (FULL TIME ONLY)_____
      (3) STUDENT (FULL TIME ONLY)_____
      (4) STUDENT (PART TIME ONLY)_____
      (5) OTHER_____

4. WHAT TOWN DID YOU COME FROM FOR THIS EVENT? _____

   WAS THIS YOUR RESIDENCE?

   YES_____ NO_____

5. IF THE ANSWER TO THE PREVIOUS QUESTION WAS BRIDGEPORT, WHAT AREA NUMBER ON THE ENCLOSED MAP IS APPROPRIATE?

6. AFTER THE EVENT, WHAT IS YOUR FIRST DESTINATION? (NAME TOWN) _____.

7. IF YOUR FIRST DESTINATION AFTER THE EVENT IS BRIDGEPORT, AGAIN INDICATE AREA NUMBER ON ENCLOSED MAP. _____

FIG. 1(a). - SPECIAL EVENT

UNIVERSITY OF BRIDGEPORT

TRAFFIC STUDY

FALL 1972

TO: ALL PARTICIPANTS

THIS QUESTIONNAIRE IS BEING DISTRIBUTED AS PART OF A TRAFFIC STUDY BEING CONDUCTED FOR THE CONNECTICUT CONSORTIUM FOR RESEARCH DEVELOPMENT. YOUR COOPERATION IN ANSWERING THESE QUESTIONS IS ESSENTIAL TO THE SUCCESS OF THIS PROJECT. YOU NEED NOT GIVE YOUR NAME.

1. Are you a: (Check one)

- ☐ Full-time Faculty
- ☐ Part-time Faculty (Equivalent of ten teaching credits or less)
- ☐ Full-time Staff
- ☐ Part-time Staff
- ☐ Full-time Student (Twelve semester hours or greater)
- ☐ Part-time Student (Less than twelve semester hours)

2. Do you live on campus?

- ☐ YES
- ☐ NO

If you live on campus and find it unnecessary to travel off campus at least once per week (Stop Here)

3a. How do you typically travel to and from campus? (Check one)

- ☐ Auto
- ☐ Bus
- ☐ Walk
- ☐ Other (Please specify)_____

3b. If answer in part a is auto, how many people usually travel with you (Check one).

- ☐ Self
- ☐ One
- ☐ Two
- ☐ Three
- ☐ Four
- ☐ Five or more

FIG. 1(b). - QUESTIONNAIRE

4. Check boxes indicating your typical arrival times for various days of the week.

	Mon	Tues	Wed	Thurs	Fri	Sat
Between 7:30 A.M. and 11:00 A.M.	☐	☐	☐	☐	☐	☐
Between 11:00 A.M. and 1:00 P.M.	☐	☐	☐	☐	☐	☐
Between 1:00 P.M. and 4:00 P.M.	☐	☐	☐	☐	☐	☐
Between 4:00 P.M. and 6:00 P.M.	☐	☐	☐	☐	☐	☐
Between 6:00 P.M. and 9:00 P.M.	☐	☐	☐	☐	☐	☐

OTHER TIME AND DAY (Please specify) _____

5. Check boxes indicating your typical departure times for various days of the week.

	Mon	Tues	Wed	Thurs	Fri	Sat
Between 7:30 A.M. and 11:00 A.M.	☐	☐	☐	☐	☐	☐
Between 11:00 A.M. and 1:00 P.M.	☐	☐	☐	☐	☐	☐
Between 1:00 P.M. and 4:00 P.	☐	☐	☐	☐	☐	☐
Between 4:00 P.M. and 6:00 P.M.	☐	☐	☐	☐	☐	☐
Between 6:00 P.M. and 9:00 P.M.	☐	☐	☐	☐	☐	☐

OTHER TIME AND DAY (Please specify)_____

6a. What is your most common origin immediately before coming to campus?

_____(Name town)

6b. If your answer in part a (above) is Bridgeport check box indicating area number on enclosed map.

☐ One	☐ Three	☐ Five	☐ Seven
☐ Two	☐ Four	☐ Six	☐ Eight

7a. What is your first destination after leaving the University?

_____(Name Town)

7b. If your answer in part a is Bridgeport, check box indicating area number on enclosed map.

☐ One	☐ Three	☐ Five	☐ Seven
☐ Two	☐ Four	☐ Six	☐ Eight

FIG. 1(b). - CONTINUED

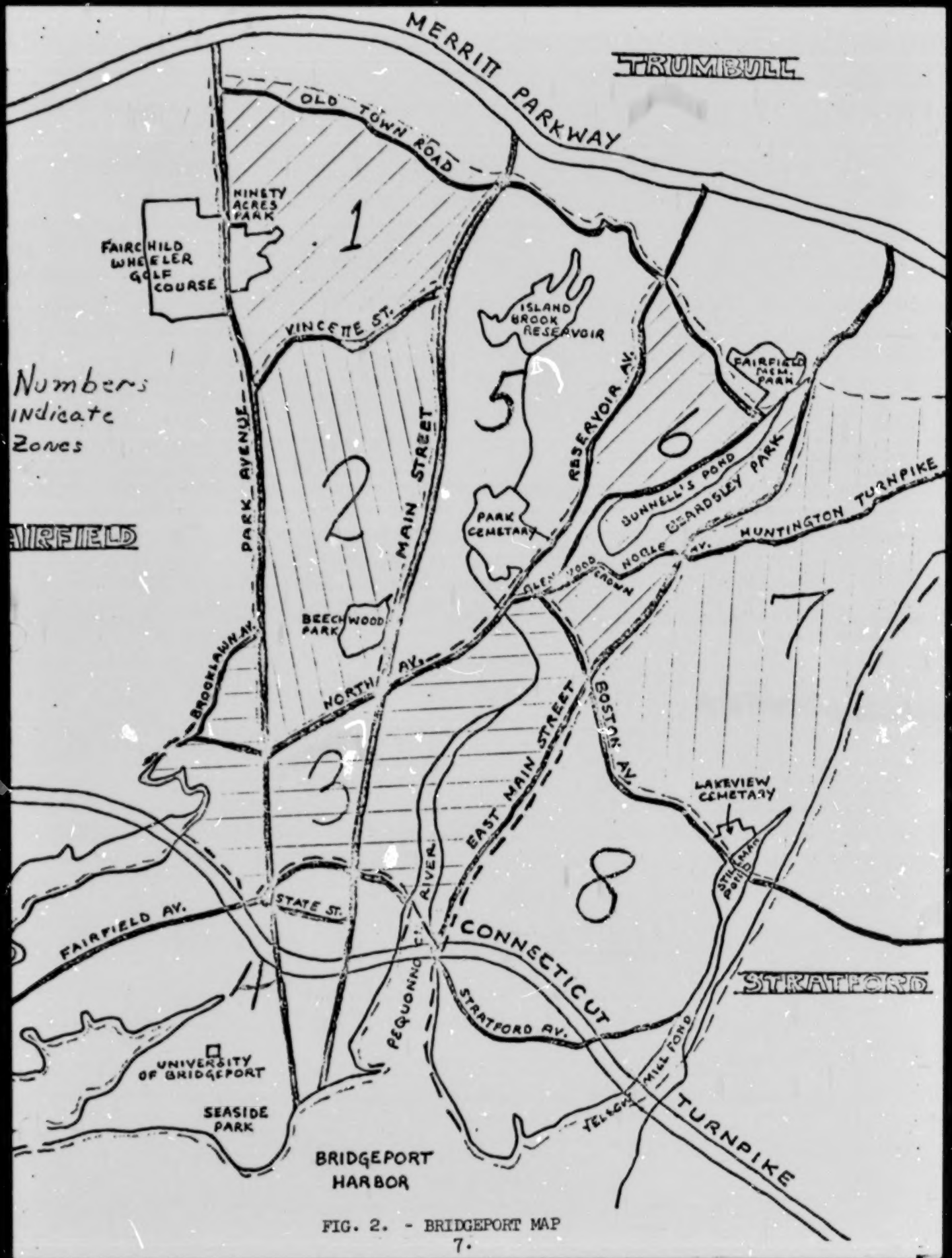

FIG. 2. - BRIDGEPORT MAP

sisted of three different events. They were: an opera, a high school band concert and a music school presentation. Approximately three hundred persons attended the combined events with thirty-four questionnaires handed out and returned.

The second event was surveyed on November 7, 1972 entitled The U. B. Percussion Ensemble. It began at 8:00 P.M. with approximately 130 people in attendance of which fifty were canvassed. Two main conclusions were reached as a result of these surveys: 1). It is necessary to canvass all entrances for each function and 2). The questionnaire must be simple and short enough so that its completion can be accomplished without removing it from the point of distribution.

Though each event is completely different in character, the survey results are surprisingly similar as one may note under the Results section.

Main Survey - The accumulation of data related to this portion of the study can be divided into six categories. Full and part time personnel were included in the survey's division of faculty, staff and students (See Fig. 1(b)). A criterion, decided upon at the outset, specified that a random sample of each group amounting to between 7% and 10% of the individual division's total population would give adequate results. The primary objective is to first devise an approach which established a random sample, accomplished efficiently and economically, and then check the results against the total population. Finally, a comparison between size of sample should be carried out to determine its adequacy. Each of these two phases have been sufficiently satisfied to give the general

feeling of a successful survey as will be seen in the Results section.

Table 1 presents statistics making up the University's population as of October 1972. Also listed in this table is the participating sample for each category with the respective percentage compared to the individual populations. The method used in obtaining the faculty's sample can be stated as: 1). The University's Administrative office supplied a list of departmental faculty. This list included faculty teaching 6 credits or more that are not considered temporary. The total list amounted to 360 members. Subsequent findings showed that the University considered 335 members to be full time and 178 to be part time. This last figure contains all temporary in addition to faculty teaching less than 6 credits. Thirty-eight members from the 360 member list were chosen using a randcm number computer program. Initially, the authors pointed toward a 10% faculty survey, but as can be seen in Table 1 the results show part time faculty (defined as individuals with equivalent teaching load of 10 credits or less) amounted to only 2.2% of its total pupulation. 2). Each faculty member chosen received two letters as shown in Letter 1 and 2. The first letter was sent to those instructors taking part one week prior to the survey's starting time, and a second letter sent five days later. Each instructor was contacted, for the survey, between December 6th and 13th 1972. In most cases the faculty members were cooperative.

The staff members to participate have been selected in a manner similar to the above except in this case the computer center provided a listing. Random numbers were generated and collated from a list containing 741 names. Seventy-nine names were chosen, and each received a copy of the questionnaire (Shown in Fig. 1(b)) plus an enclosed letter of explan-

TABLE 1. - NUMBER OF SURVEY PARTICIPANTS AND UNIVERSITY POPULATION (AS OF FALL 1972)

	UNIVERSITY	PARTICIPANTS	PERCENT OF TOTAL	
FACULTY				
FULL-TIME	335	33	9.8	7.2
PART-TIME	178	4	2.2	
STAFF				
FULL-TIME	490	33	6.7	6.4
PART-TIME	101	5	5.0	
STUDENT				
FULL-TIME	4499	462	10.3	7.7
PART-TIME	3451	153	4.4	

UNIVERSITY OF BRIDGEPORT

BRIDGEPORT, CONNECTICUT 06602

COLLEGE OF ENGINEERING

Dear Faculty Member:

HECUS (Higher Education Center for Urban Studies) has awarded a grant to the Engineering College at the University, in order to undertake an origin and destination transportation survey and analysis of the existing University population.

The purpose of the project is as follows:

1) To provide information related to particular transportation problems confronting the institution;
2) To provide long range guidance in fitting the academic community into the complex urban transportation system within and surrounding the Bridgeport area; and
3) Identify the major transportation corridors being used in going to and from the particular institution and estimate the number of riders within each mode of travel. In addition, it is proposed that with the information gathered here at the University the survey can and will be conducted at other HECUS schools.

This letter is not only to enlighten you about the project but also to enlist your assistance. In order to gather the data necessary to complete the study, it is required that the groups below be surveyed.

1) Faculty
2) Staff
3) Students

Your assistance will possible be requested in two ways, a) answering a questionnaire and b) distributing and collecting student questionnaires in the classroom. Very shortly, therefore a random list of faculty is to be generated and the survey phase of the study carried out. If at that time you have any questions, please notify me.

Thank you.

Anthony N. Palazzotto

Eff. 226

UNIVERSITY OF BRIDGEPORT

BRIDGEPORT, CONNECTICUT 06602

COLLEGE OF ENGINEERING

December 5, 1972

Dear Faculty Member:

Recently you received a letter discussing the transportation study being carried out at this University. It mentioned the possibility of particular faculty participation. Well, it has turned out that your name occurred on our random number listing, and thus your assistance is requested in two ways, a) please answer one of the enclosed questionnaires and b) please distribute the remaining questionnaires to your students. It would greatly facilitate the data collection if you could allow the necessary time for the form's completion in class. The engineering graduate assistant will be there, if necessary, to help in any way possible.

Thank you for your cooperation.

Sincerely,

Anthony N. Palazotto

Anthony N. Palazotto
(ext. 226)

ation. Detailed checks of the names indicated that the computer list contained temporary help. Table 1 shows a more realistic number of full time and part time staff (working less than 37.5 hours). The staff that actually participated gave reasonable numbers to work with.

The last group studied is the student body. The intent has been to obtain a sample of approximately 7-10% including full and part time undergraduate and graduate students. Instead of incorporating the random number approach referred to in the case of faculty and staff members, the method developed used classes of each instructor participating in the study. It was decided that approximately 30 students per faculty member should be solicited. In order to create a more random distribution, the student selection occurred from at least two classes of each surveyed instructor. If the instructor had three classes, class one and two were used, and if he had four classes class one and three became the choice (one corresponds to the first class of the week, two the second etc.). A random number selection, between 1, 2 and 3 or 1, 2, 3, and 4 determined the actual class choice. Once the instructor's class schedule became available, a list of appointments could be written.

Each class designated could only be surveyed with a greater amount of manpower, and thus the recruitment of engineering students was necessary. In order to avoid any additional complications, the recruits were briefed and presented with written instructions. Students and instructors were then surveyed, at the same time. Again, Table 1 shows that the resulting student group gave a reasonable working sample. It will also be noted that the percentage of groups (i.e. faculty, staff, student) turned out to be about 7%.

As a closing paragraph to this section certain comments are directed toward the questionnaire. It can be observed in Fig. 1(b) that each category surveyed is covered (i.e. faculty, etc.). The questions have been tested before hand by several faculty, staff and students to determine if any difficulties arose. Consequently, because of the experience gained in the special events survey, many problems were anticipated and corrected before testing. It should be mentioned that the map of Bridgeport was once more incorporated. Furthermore, it is recommended that if this questionnaire is again used, a time slot between 9 PM-7:30 AM be included.

RESULTS

The results discussed herein pertain specifically to certain areas developed from a computer output. This will be elaborated upon under the main survey. Those areas presented herein give an idea of possible findings, but if the reader would like greater detail, he should consult the total computer summary which has been documented with this report. It was decided not to carry out any sophisticated computer analysis for the two special events considered, and confine the analysis to data obtained directly within the questionnaire. Yet, even here discussion is possible within the context of limited results for each event by making comparisons.

Special Events - Table 2 presents statistics developed for the two special events. It should be recalled that event one encompassed three separate, relatively nonhomogeneous, affairs. Event two was specifically oriented to a given event. Thus, any attempted comparison between the two should point out special homogeneity which could then be interpreted as a normal occurrence. With this in mind, one can observe from the first question that a majority of attendees would be on campus no matter what event was being presented. This, of course, would be expected considering the nature of university life. But, what is somewhat surprising is the fact that for both events the proportion of outside participants amount to as much as 40%. Question 2 indicates between 60% to 80% of the attendees come by auto, but it is also interesting to note that, for the most part, more than one person came in a particular auto. Question 3(b) points

TABLE 2. - SPECIAL EVENTS
(PERCENTAGE VALUES OF ATTENDEES)

	Special Event 1	Special Event
Question 1		
Percent of Persons That Would be on Campus If Not Attending Event	58	60
Question 2		
Mode of Travel		
Auto	76	62
Walking	24	38
Question 3		
a) Number in Party Who Came By Auto Only		
Only One	19	29
Only Two	35	32
Only Three	12	23
Only Four	19	13
Only Five	12	0
Only Six	3	3
b) Number of Party In		
Faculty	18	2
Full-Time Student	33	34
Part-Time Student	18	14
Other	41	50
Question 4		
a) Origin of Travel		
Bridgeport	52	54
Fairfield	14	6
Norwalk	10	4
Westport	7	4
Trumbull	0	12
Milford	7	4
Greenwich	0	4
Others	10	12
b) Number Coming From Their Residence	97	97
Question 5		
Number From Area In Bridgeport		
Area Number		
2	13	0
3	0	15
4	67	74
5	7	0
6	13	0
7	0	4
8	0	7

TABLE 2. - (Continue)

Question 6	Special Event 1	Special Event 2
Destination After Event		
Bridgeport	52	54
Fairfield	9	6
Norwalk	9	4
Trumbull	0	12
Milford	6	4
Stratford	9	0
Westport	6	4
Others	9	16
Question 7		
If Destination is Bridgeport What Area Number?	Area Number	
	1	0	0
	2	13	0
	3	0	11
	4	81	78
	5	0	0
	6	6	0
	7	0	4
	8	0	7

out that approximately one-third of the attendees can be classified as full time students. Questions 4 and 6 show approximately 50% of the attendance come from and go to Bridgeport while just about everybody is coming from their residence. The questionnaire tried to determine which area of Bridgeport contributed the greatest share of individuals. As would be expected, almost three-quarters of the people going to a special event would come from the surrounding area of the institution. One may observe that Fairfield, Westport and Milford are towns contributing uniform percentages of participants to individual events.

The discussion of special events can be summarized by stating that those conclusions observed in previous paragraphs now give some evidence to what may be called, logical conclusions. It becomes possible, with the given statistics, to allow for certain factual judgments relating to special event projects in university life. Judgment in parking facilities and advertising are just two areas which can be affected by surveys of the nature presented herein.

Main Survey - A computer program was designed to analyze the variety of transportation modes and movements to and from the University. As pointed out at the beginning of the Results section, a discussion of only certain data is to be presented.

The reader can obtain some flavor of the main program by observing the flow diagram shown in Fig. 3. The program handled, as input, approximately 60,000 bits of information and produced more than 250,000 areas of output. It categorized the movement to and from 25 towns and

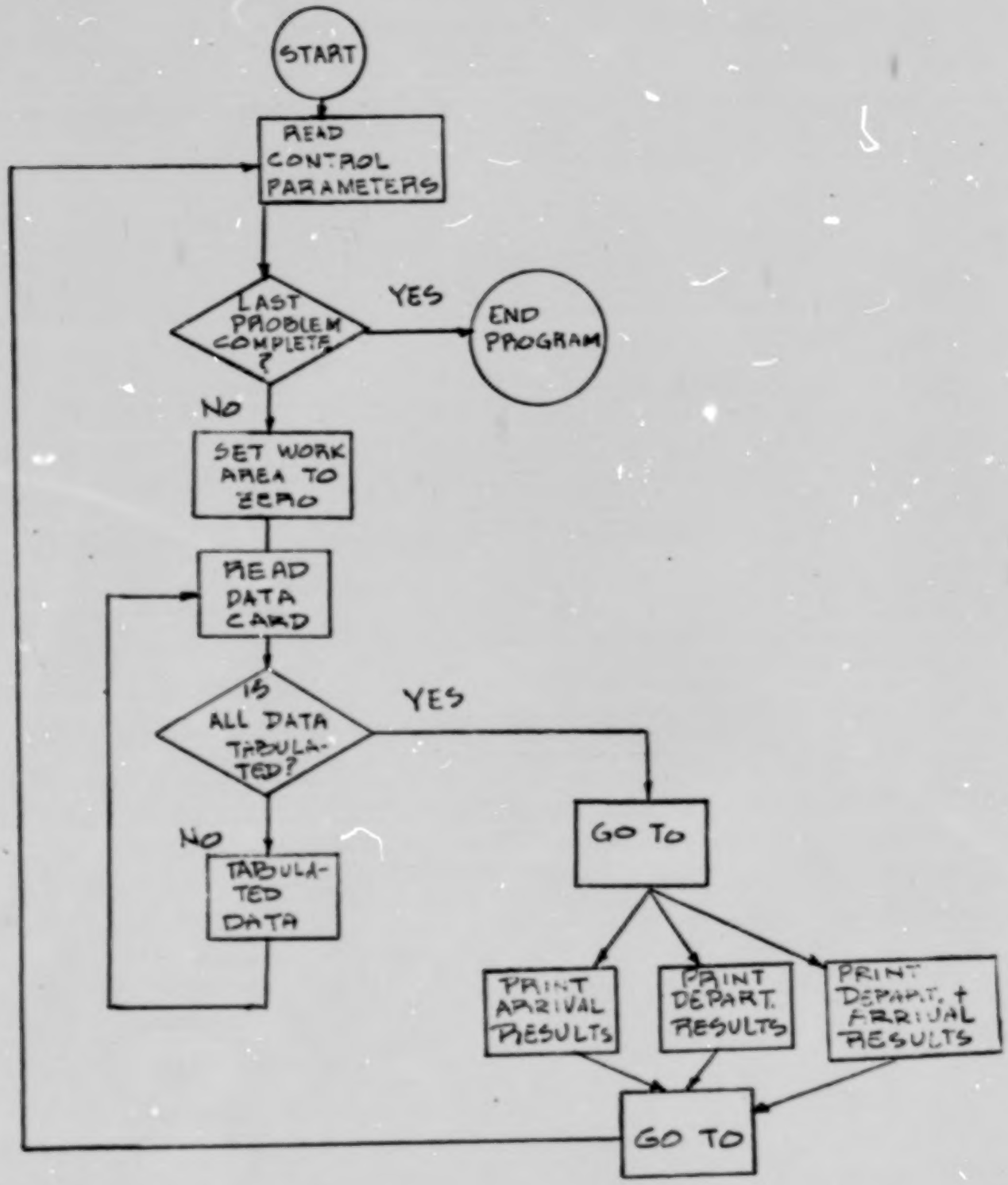

FIG. 3 - FLOW CHART

tabled these movements into specific time slots. Furthermcre, a straight line extrapolation to the overall University has been carried out for each area of interest. Of course, the main concept dealt with is the survey itself, not so much the algorism used in handling the survey. Let us first discuss the questions: 1) Are we really dealing with a random survey? and 2) Is the survey's size adequate to give accurate results or should it be increased or may it be decreased?

The answer to the first question is rather speculative. Statistically, sample size more or less guarantees randomness, but the authors wanted a survey whose accuracy could be verified in some further fashion. In order to do this four towns have been chosen, using student population, as shown in Table 3. The resulting actual figures were obtained from the computer which searches out particular zip codes. The towns picked have some representable characteristics. Three of them are located within a 10 mile radius of Bridgeport and are not big enough to dominate results. The other is a town of approximately 100,000 people removed from the campus by about 20 miles. It is felt that since the four towns contribute relatively the same student population to U. B., and since this contribution individually is not dominate, then any error occurring would be magnified. Therefore, if the survey population compares with the four town population, individually as well as totally, then it would be encouraging to feel that the survey is random and fairly accurate. At least, it can be agreed that one check point has been satisfied. Thus, Table 3 shows this comparison which produces a somewhat satisfying feeling toward the canvassing techniques. Again, the check point is only in relation to full and part time students and does not include faculty and

TABLE 3. - PERCENTAGE COMPARISON
BETWEEN ACTUAL STUDENT ENROLLMENT
VERSUS PREDICTED ENROLLMENT FROM SURVEY

TOWN	STUDENTS			
	FULL-TIME		PART-TIME	
	ACTUAL	PREDICTED	ACTUAL	PREDICTED
Fairfield	3.3	6.6	8.8	5.2
Milford	1.4	3.1	4.6	5.9
Westport	1.4	3.0	4.8	3.8
Stamford	2.0	1.2	8.0	4.0
Total Related to the Four Towns	8.0	14.1	27.6	19.6

Percentages indicated are evaluated with respect to the total university population.

staff, but the student body makes up over 85% of the University population.

In order to answer question 2, one must refer to Table 4. An attempt has been made to verify the survey's homogeneous nature assuming a random sample is present. The procedure followed compared the 100% sample with 75% and 50% sample sizes obtained by eliminating every fourth and second individual respectively, from the input data. Comparison is then made relative to time departure for the first three days of the week. There is an almost exact comparison between the full and 3/4 size survey. Period 4-6PM, Monday and Tuesday, show about a 10% difference faculty and staff-wise. Yet, comparison between these sample sizes are excellent for student samples. The difference between full and half sample is fairly good as well, but certain time slots produce differences as great as 15%. Thus, it appears that a sample 75% of the present size would give comparable results. The authors feel confident in the overall accuracy of this study after evaluating the survey's check and homogeneity.

As a first step in reporting the survey's results let us look at Table 5. Percentages of travel mode used by individuals to and from the University is presented. It is strikingly brought out that a main mode of travel is by automobile with approximately 90% done in this fashion. Furthermore, most of these travelers ride by themselves. Approximately 1500 full time students drive to and from school alone while about 2700 part timers do the same thing. Thus, a possibility exists for developing another mode of travel for a large portion of the University once corridors of movement are looked at and feasibility studies carried out.

It becomes possible to determine the amount of automobile arrival and departures at given time intervals per day. The survey must first

TABLE 4. - COMPARISON BETWEEN FULL SURVEY, SEVENTY-FIVE PERCENT OF SURVEY AND FIFTY PERCENT. NUMBERS ARE IN PERCENTAGE OF INDIVIDUAL CATEGORY

DEPARTURE TIME	FACULTY			STAFF			STUDENT		
MONDAY	1	3/4	1/2	1	3/4	1/2	1	3/4	1/2
7:30AM-11AM	0	0	0	0	0	0	4	5	6
11AM- 1PM	3	4	7	0	0	0	6	7	6
1PM- 4PM	9	12	7	12	12	6	18	17	16
4PM- 6PM	64	54	67	73	79	81	9	9	10
6PM- 9PM	15	12	13	12	8	6	15	14	15
9PM-11PM	3	0	0	3	4	0	2	2	2
TUESDAY									
7:30AM-11AM	3	8	7	0	0	0	5	5	6
11AM- 1PM	3	4	7	0	0	0	6	6	6
1PM- 4PM	0	0	0	6	4	0	16	16	16
4PM- 6PM	54	46	53	67	75	81	11	10	10
6PM- 9PM	12	12	7	12	4	0	14	14	14
9PM-11PM	9	12	0	3	4	0	2	2	1
Wednesday									
7:30AM-11AM	0	0	0	0	0	0	5	5	5
11AM- 1PM	0	0	0	0	0	0	9	10	10
1PM 4PM	6	8	7	12	12	6	15	14	13
4PM- 6PM	52	50	67	67	75	81	7	7	6
6PM- 9PM	27	25	7	15	12	6	16	14	15
9PM-11PM	6	0	7	6	4	0	1	1	2

TABLE 5. - PERCENTAGE FOR EACH MODE USED

MODE USED	FACULTY		STAFF		STUDENTS	
	FULL-TIME	PART-TIME	FULL-TIME	PART-TIME	FULL-TIME	PART-TIME
Autos	88	100	97	70	85	93
a) Self	82	100	82	35	53	82
b) One Passenger	6	0	9	35	15	9
c) Two "	0	0	3	0	8	2
d) Three "	0	0	3	0	7	0
e) Four "	0	0	0	0	2	0
Bus	3	0	0	0	3	2
Train	0	0	0	0	1	1
Walking	3	0	0	0	8	3
Others	6	0	3	30	3	1

Count does not include individuals who live on campus and do not leave at least once per week. (Approximately 27% of full-time Students)

be updated to the university population, but to do this two assumptions were made: 1) a random sample is dealt with and 2) each category participant (e.g. full time faculty, one passenger) drive together. The random sample assumption says, of course, a sample reacts similar to the total university. Therefore, if 12% of the full time students drive two in a car then 12% of the total full time student population drive under this classification and

$$0.12(4499 \text{ full time student}) = 540 \text{ (driving 2 in a car)} \qquad (1)$$

If Eq. (1) is divided by 2 (because two persons are driving together as a group), the number of cars for this group becomes

$$\frac{540}{2} = 270 \text{ cars} \qquad (2)$$

The calculations just presented are carried out for each rider category and a total car count is found. Figures 4, 5, and 6 indicate the arrivals and departures of autos for certain time slots over a five day week. It can be seen that critical time intervals for movement would be the 7:30 AM-11 AM and 6 PM-9 PM. The greatest accumulation of cars occurs at the first or second time period during the morning. This last statement could be used in evaluating a parking requirement at a given institution.

In order to establish corridors of travel, the region within a 30 mile radius of Bridgeport has been constructed and is shown in Fig. 7. Figures 8 to 12 present data relative to population movement during certain times over a five day week considering arrivals only. It appears the most heavily traveled corridor is the region 6-5-4. In particular, 1400 persons move through region 4 during the 7:30 AM-11 AM period on Monday. For the same interval 150 persons move through region 5. Again, for the same interval, 800 persons move through region 7. These figures give a picture of a demand corridor and thus present information which can be studied to attract various modes of travel such as bus transportation.

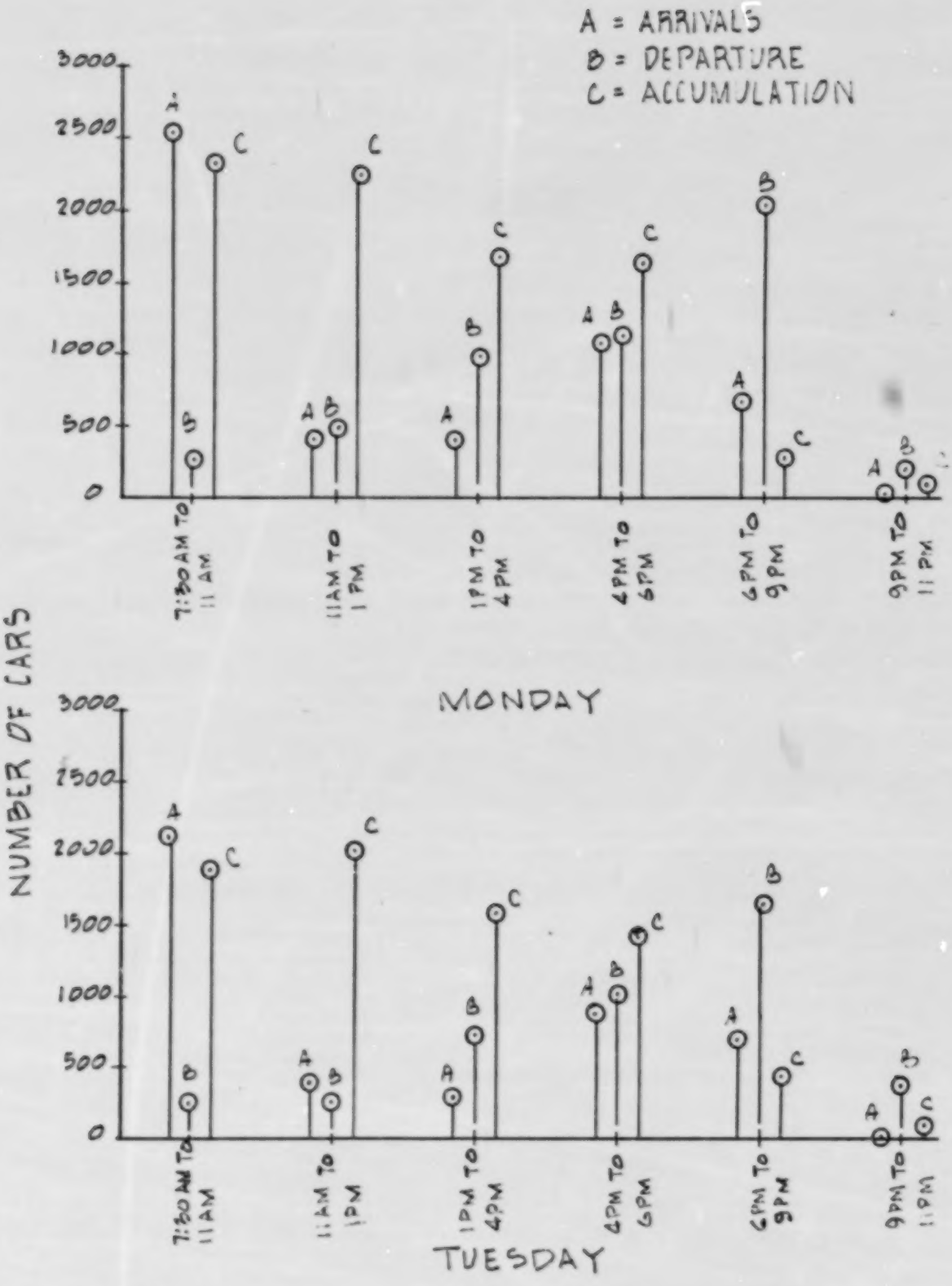

FIG. 4 - DAILY ARRIVAL AND DEPARTURES OF AUTOS
MONDAY AND TUESDAY

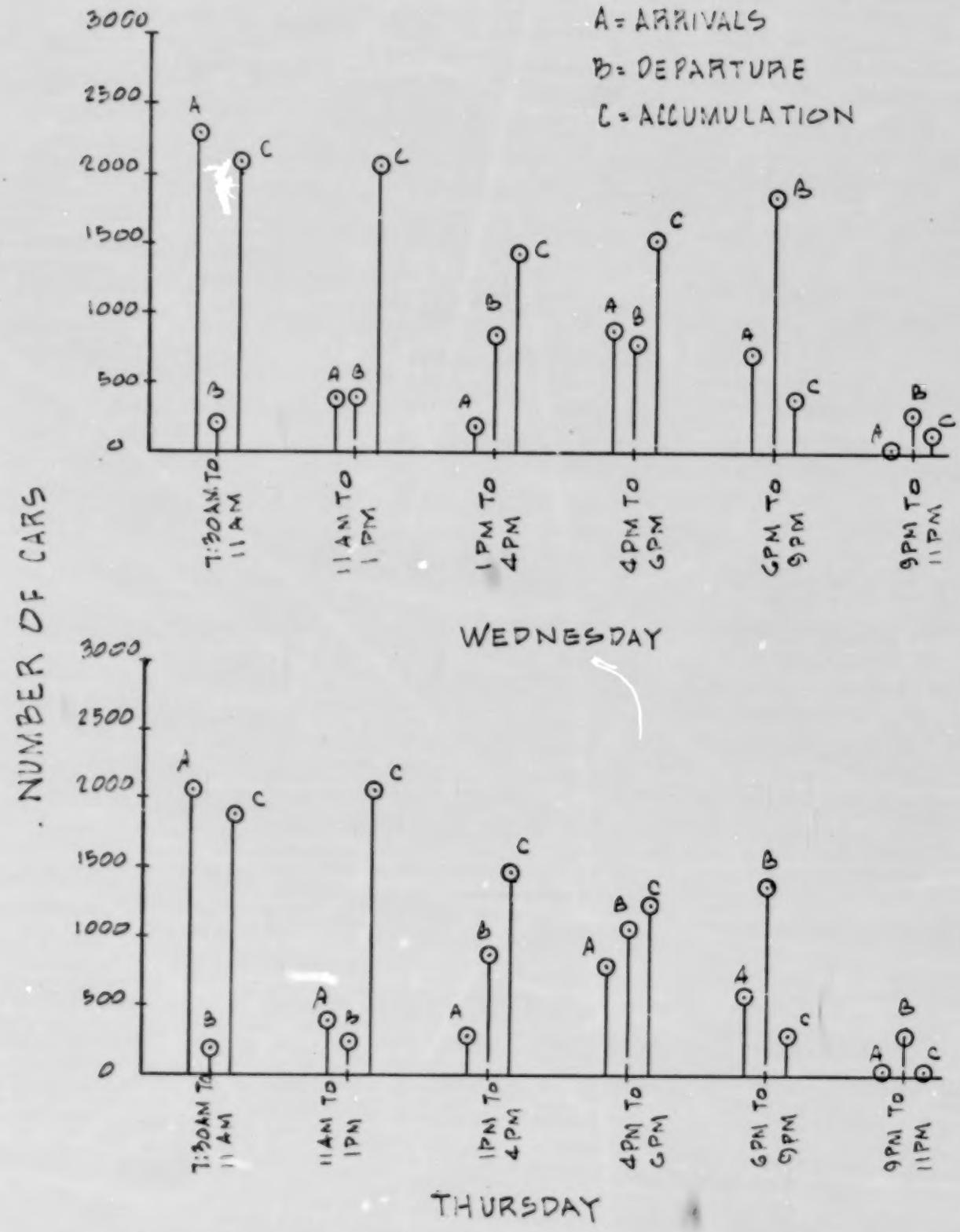

FIG. 5 - DAILY ARRIVAL AND DEPARTURES OF AUTOS
WEDNESDAY AND THURSDAY

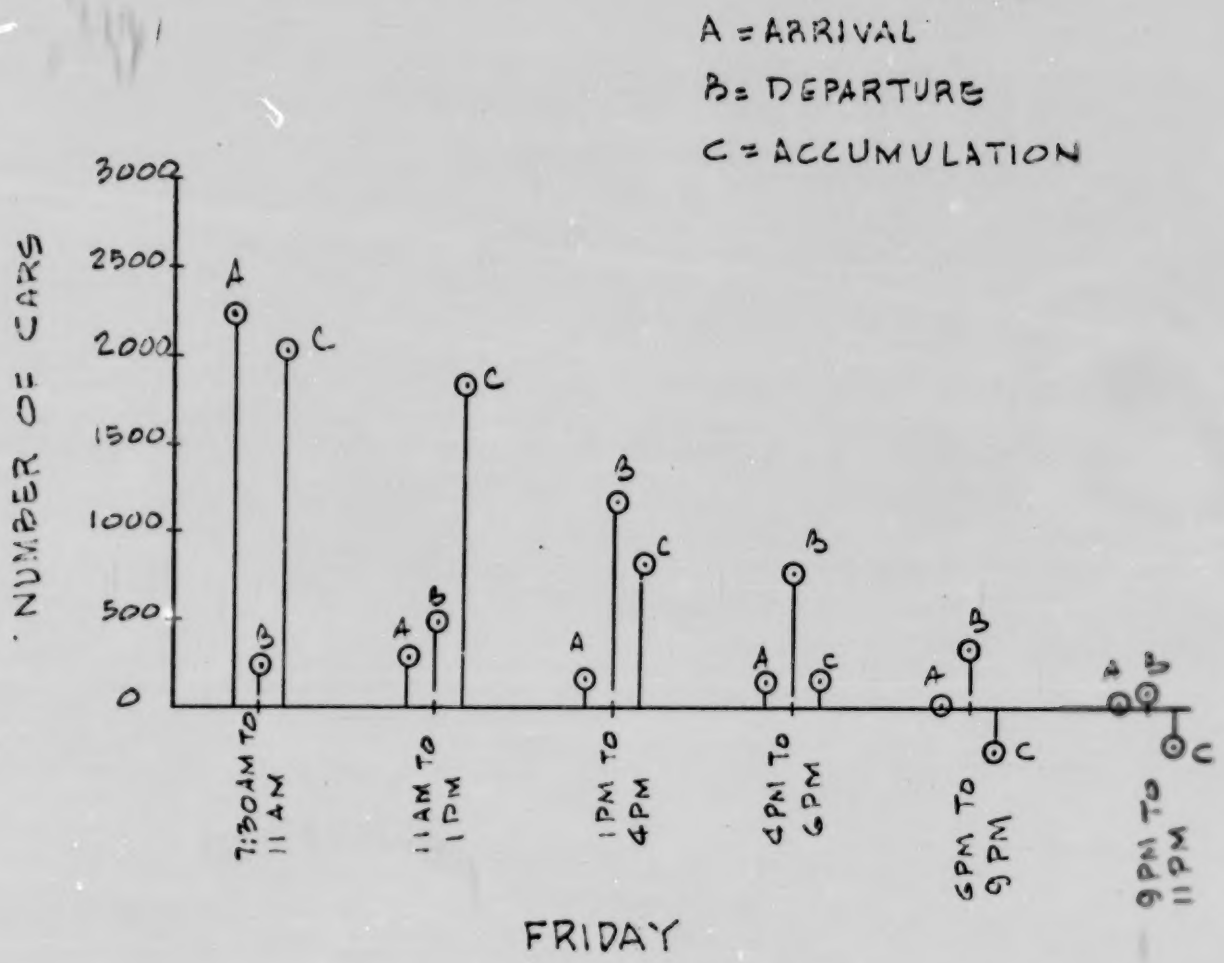

FIG. 6 - DAILY ARRIVAL AND DEPARTURES OF AUTOS FRIDAY

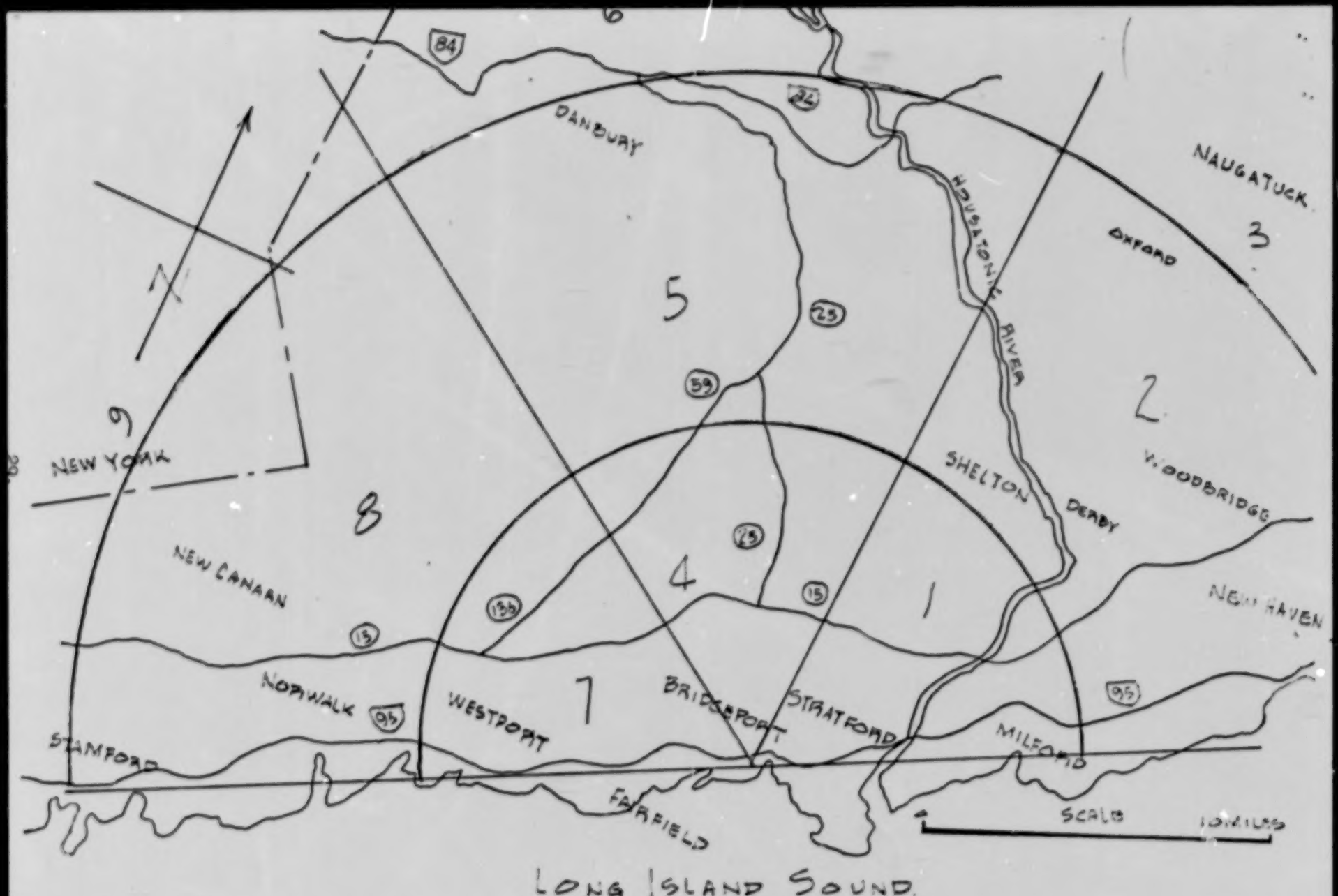

FIG. 7 - REGIONS OF TOWNS

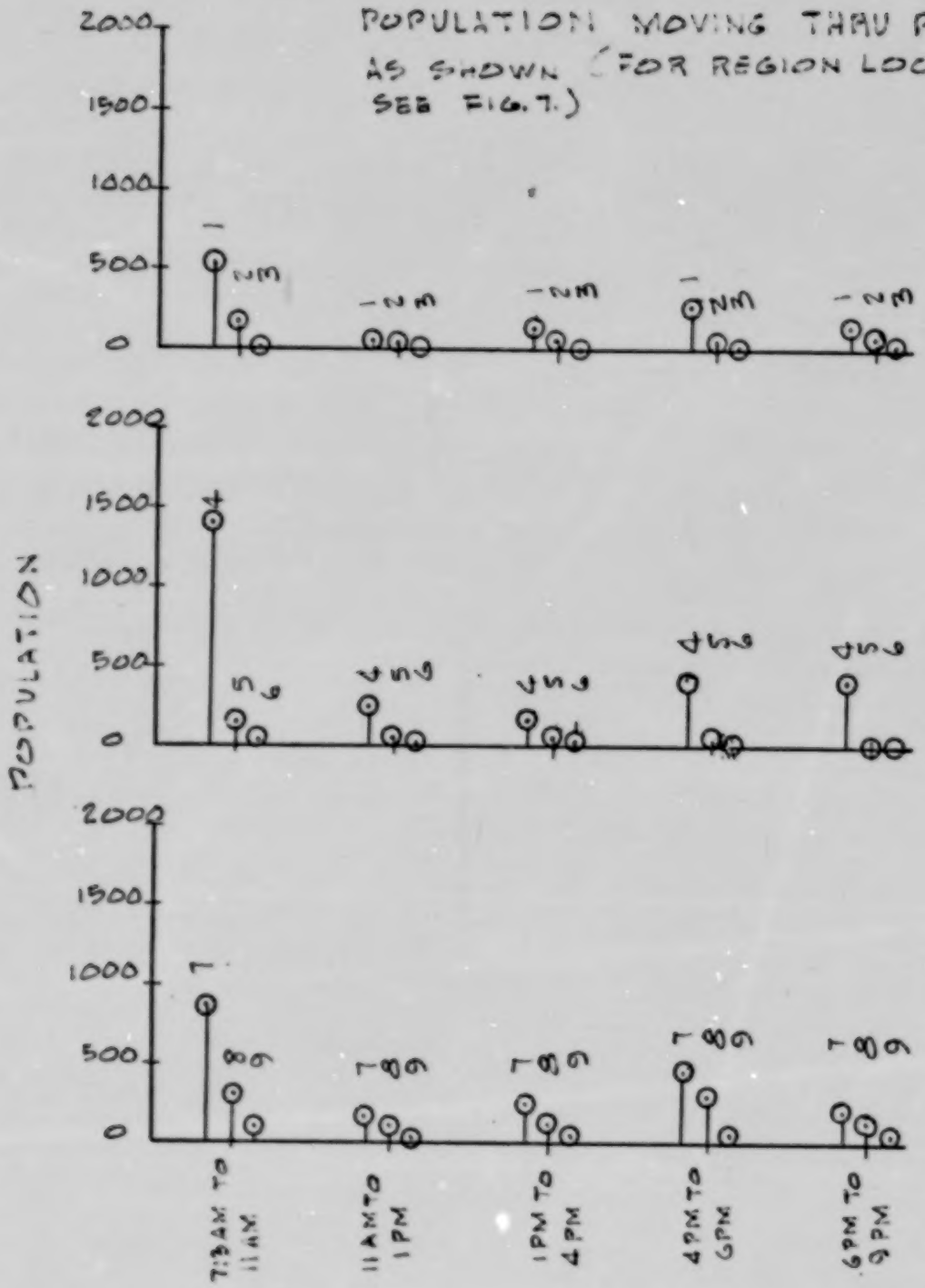

FIG. 8 - POPULATION ARRIVING AT U. B.
MONDAY

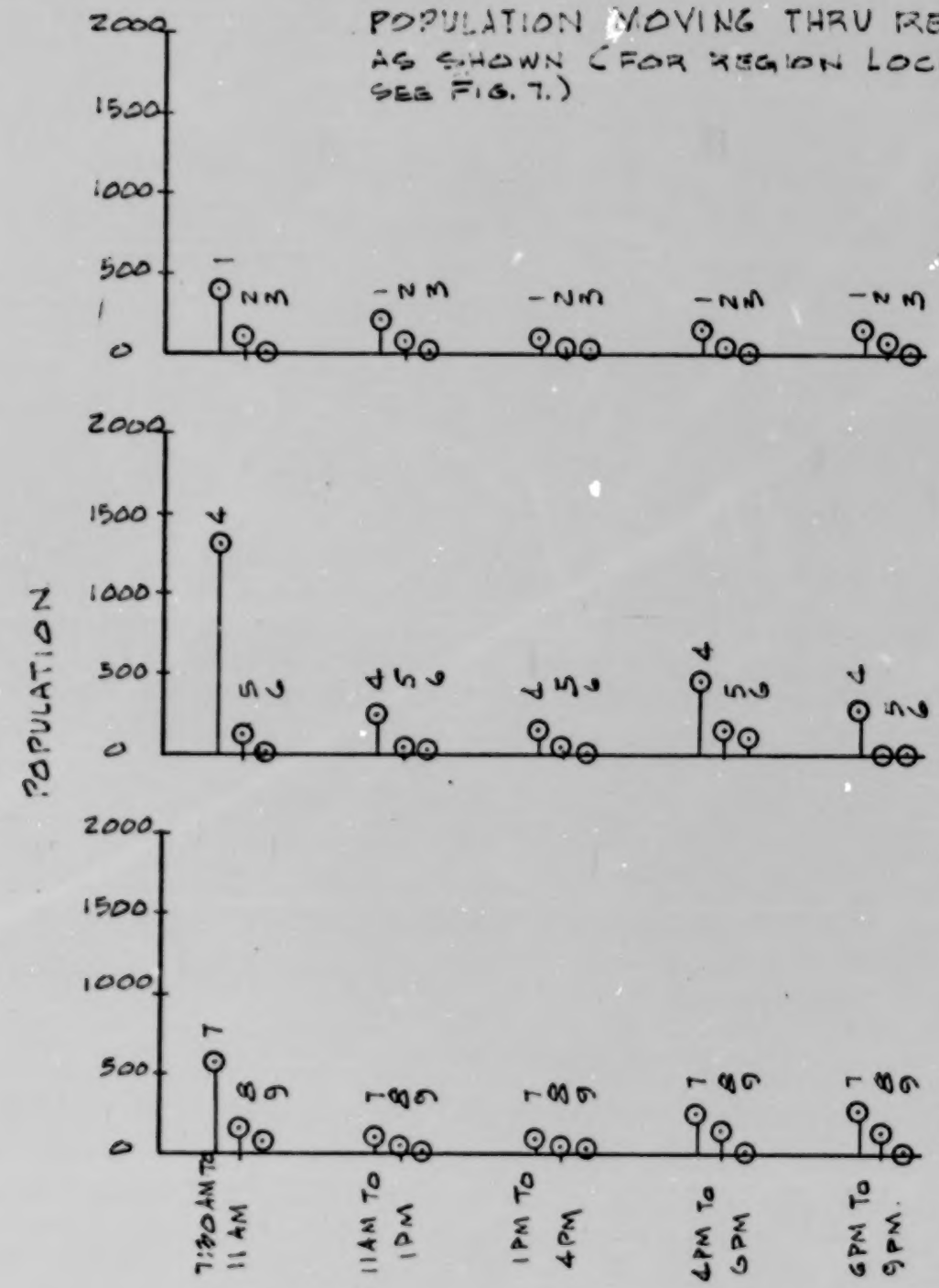

Fig. 9 - POPULATION ARRIVING AT U. B.
TUESDAY

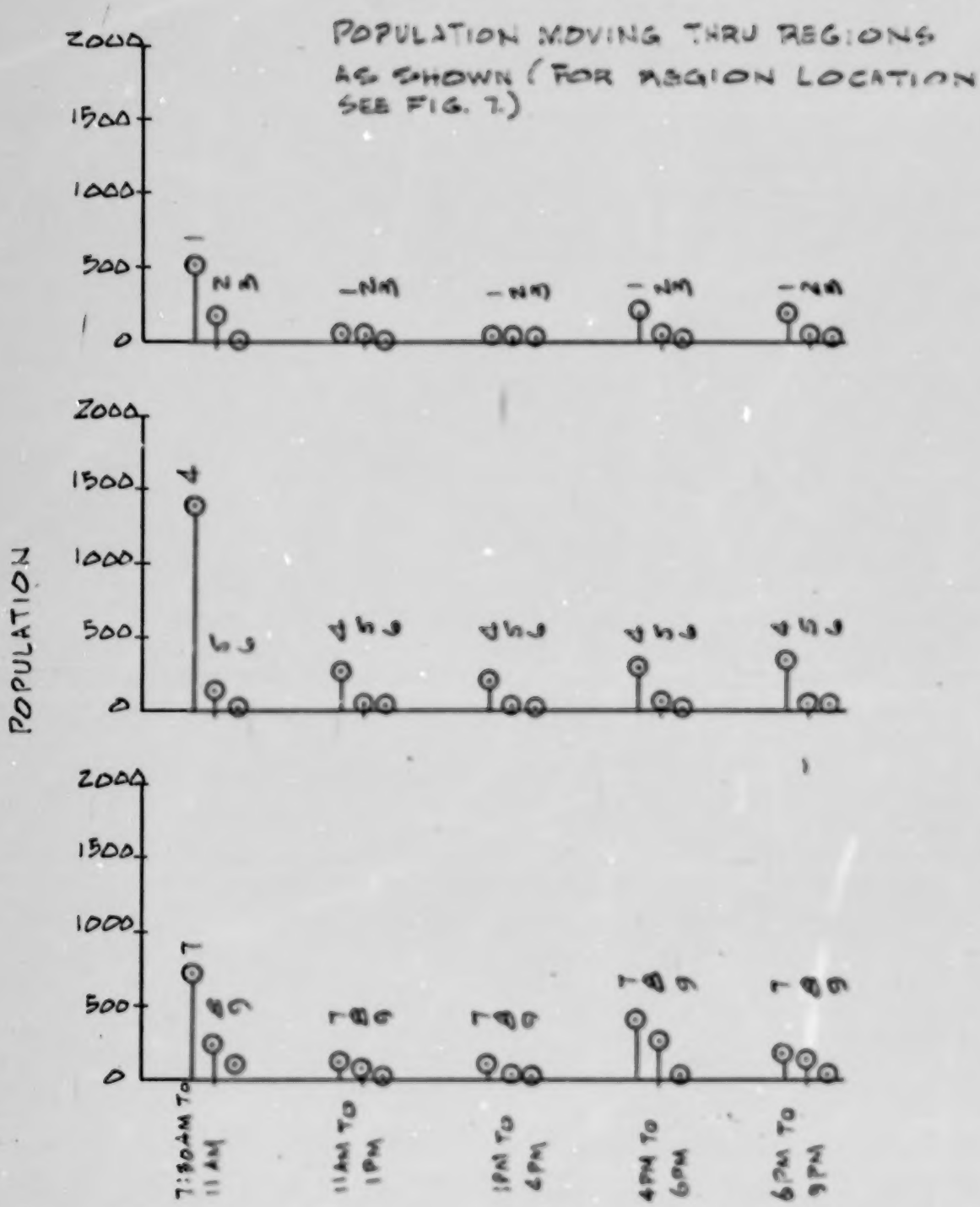

FIG. 10 - POPULATION ARRIVING AT U. B. WEDNESDAY

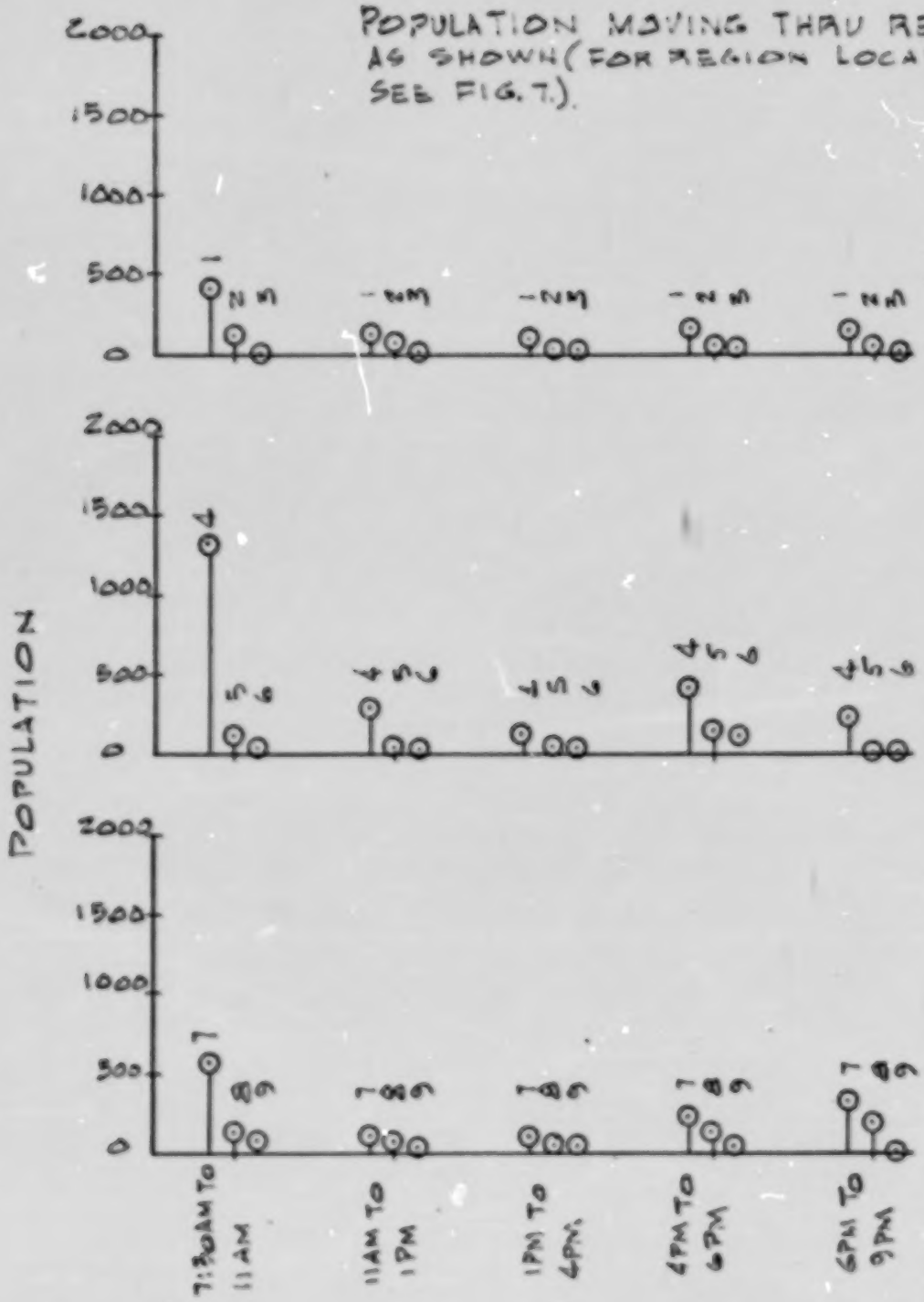

FIG. 11 - POPULATION ARRIVING AT U. B. THURSDAY

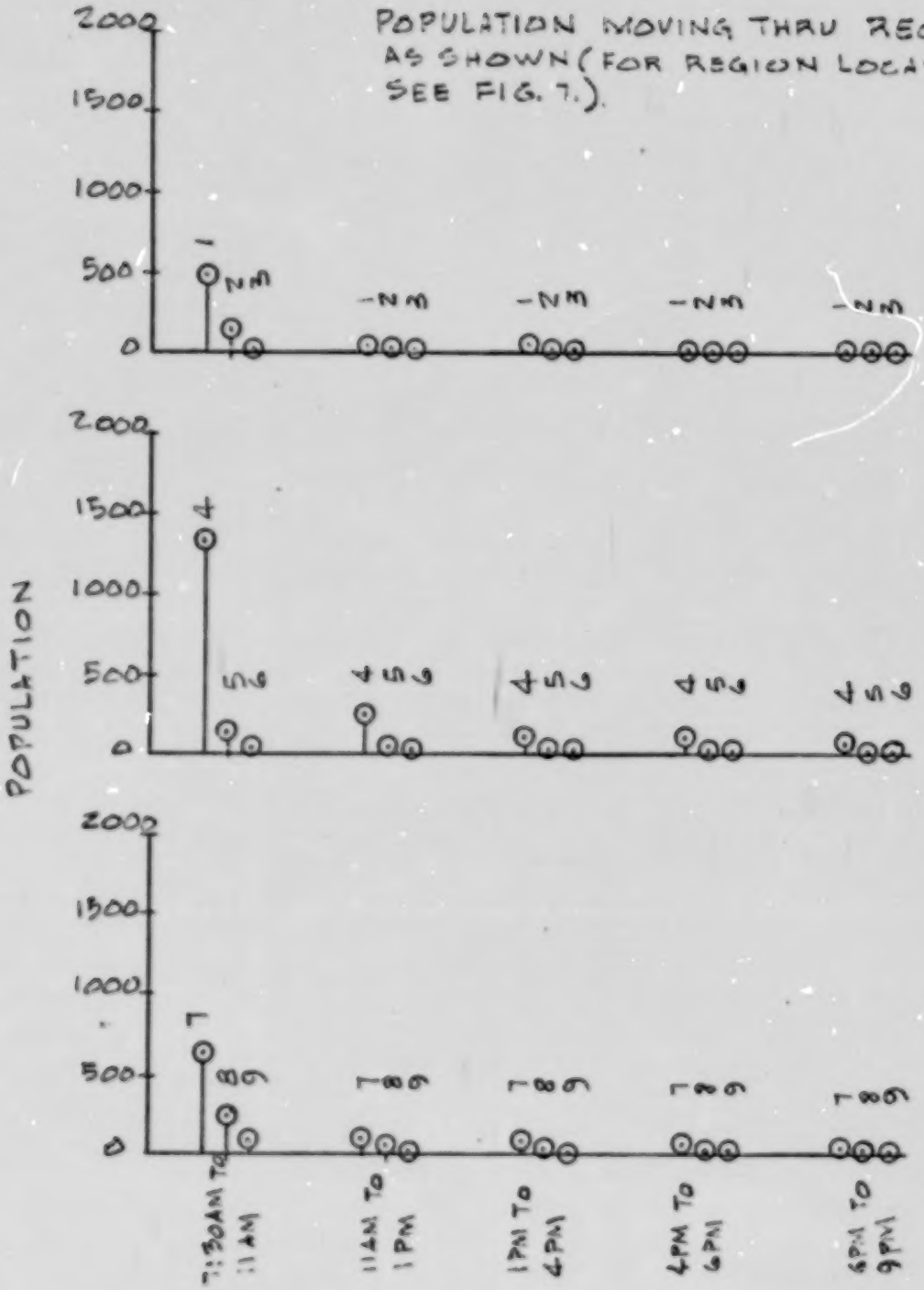

FIG. 12 - POPULATION ARRIVING AT U. B.
FRIDAY

Figures 13 to 17 do the same thing as above, but in this case car movement is considered. Region 4 is attracting the greatest number of cars as they approach the University. The data presented in these figures can be used for various transportation problems affecting the institute in addition to the City of Bridgeport. This may include movement capacity studies on various city streets, providing special bus service to a given population area which can be affective in improving enrollment, and finally, the data can contribute to a transportation network between HECUS institutes. It appears to be possible that, if an interconnecting transit system were established, certain facilities could be shared.

As a final point of discussion let us turn our attention to Table 6. This table presents an estimate of full and part time student movement from specific areas (see Fig. 1 (b)) within Bridgeport. Through this data, it is possible to get a good idea of the local pockets of student population, and thus plans may be developed to service the given area or areas. The table does not include the entire set of statistics which the computer produces. Data has been accumulated relative to time of day and day of week for the movement of each individual, consequently it becomes possible to obtain a better fix on population flow.

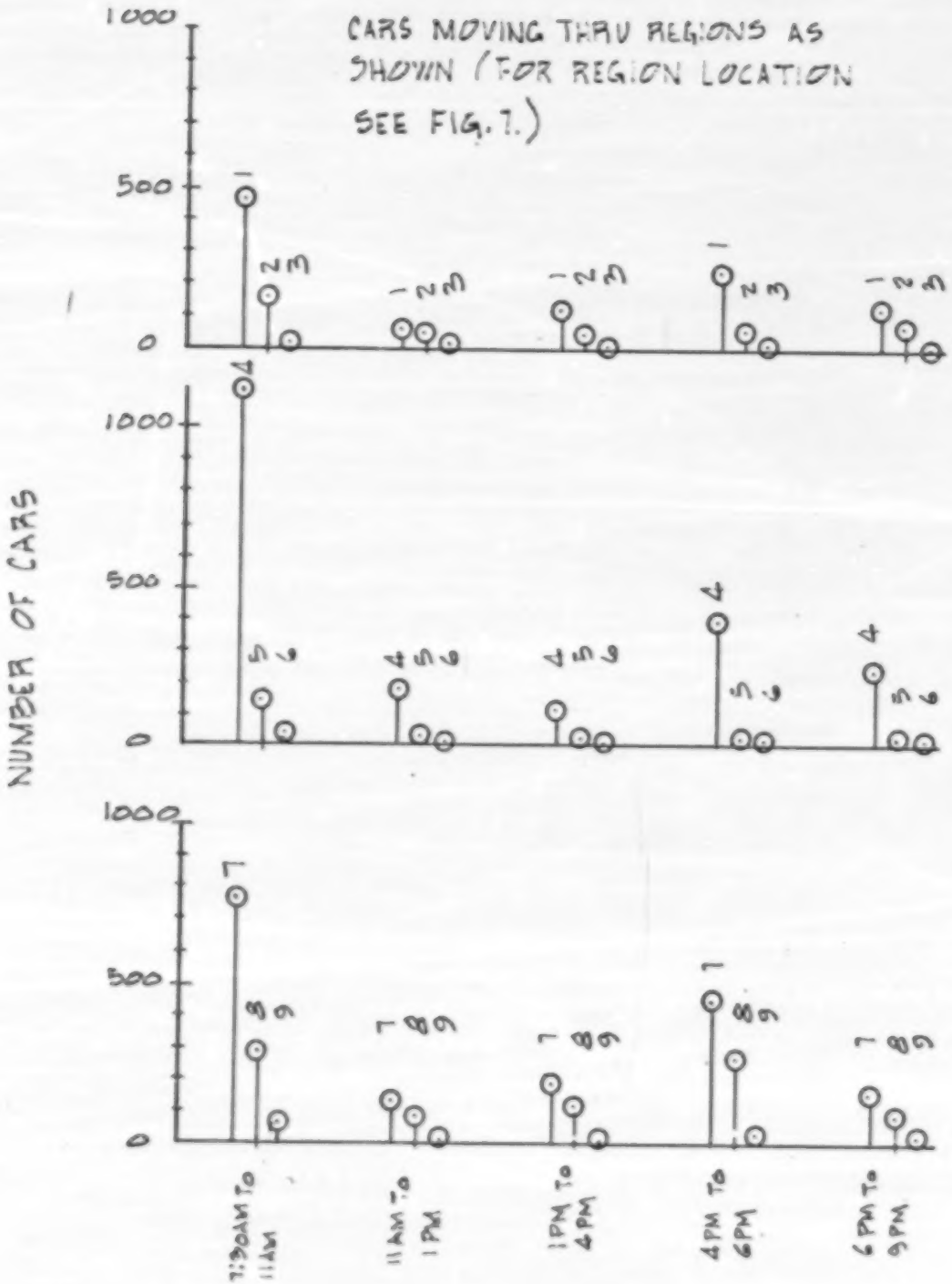

FIG. 13 - AUTOMOBILE ARRIVALS AT U. B.
MONDAY

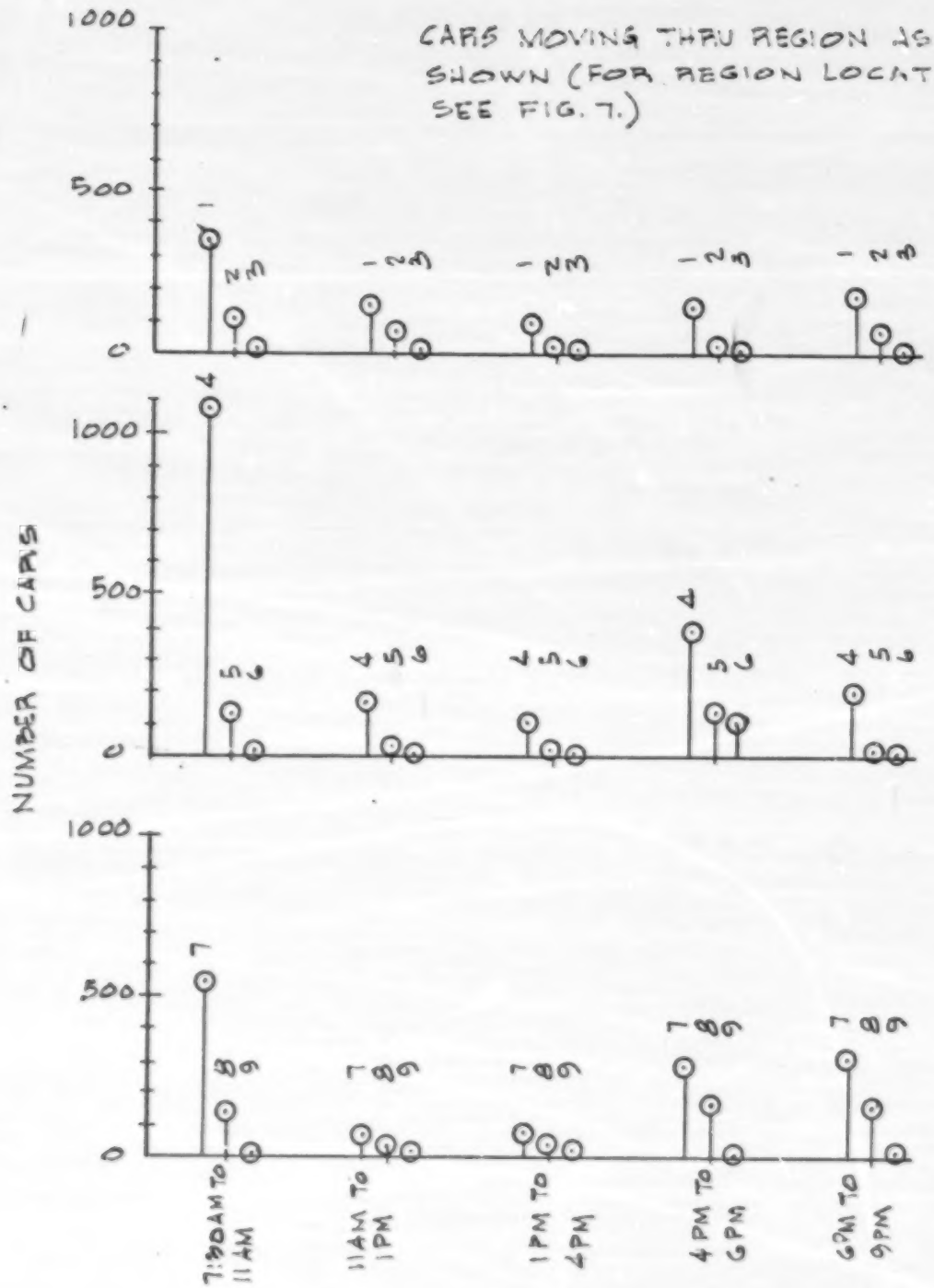

FIG. 14 - AUTOMOBILE ARRIVALS AT U. B.
TUESDAY

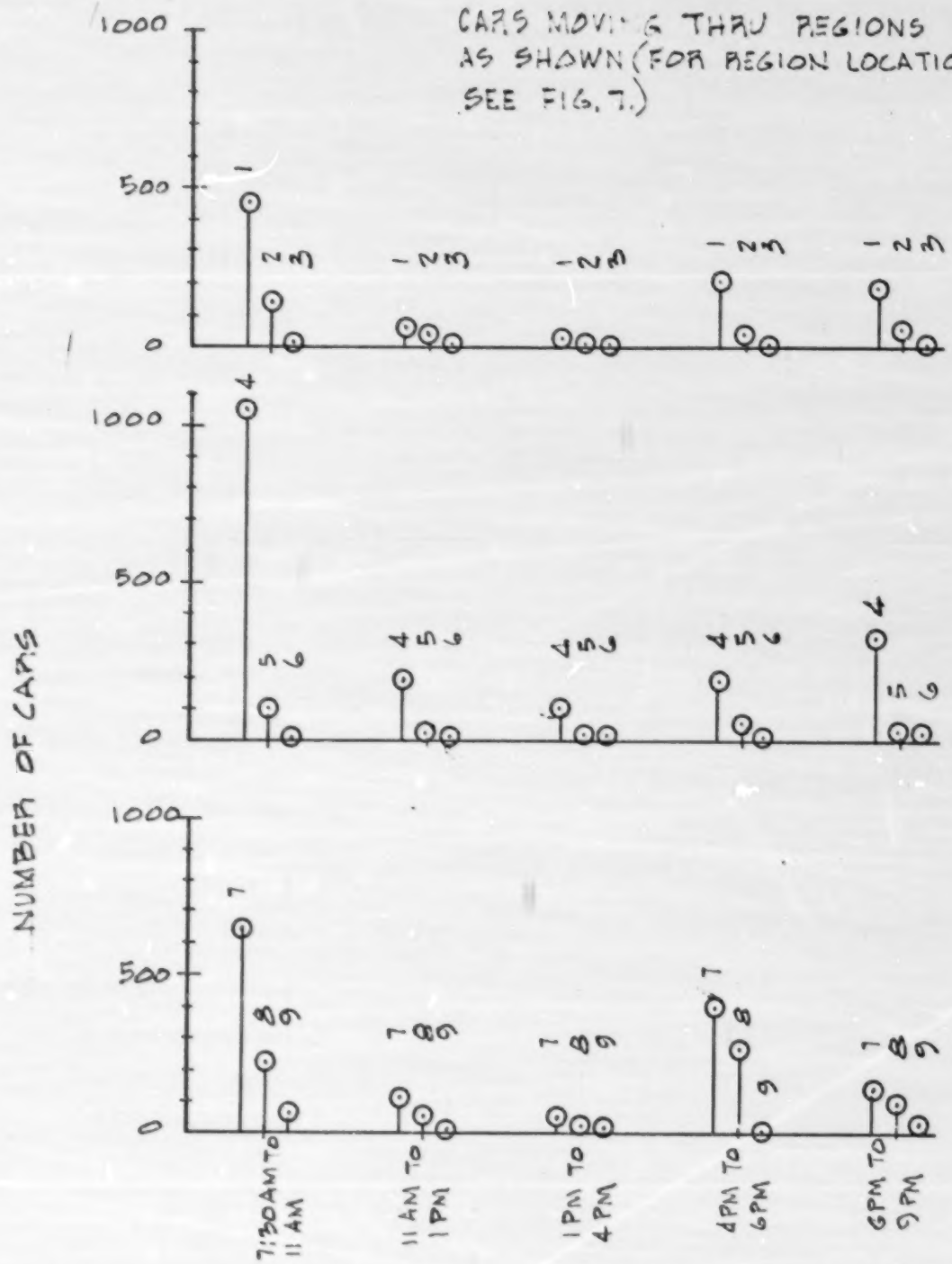
CARS MOVING THRU REGIONS AS SHOWN (FOR REGION LOCATION SEE FIG. 7.)
NUMBER OF CARS
1000
500
0
7:30 AM TO 11 AM
11 AM TO 1 PM
1 PM TO 4 PM
4 PM TO 6 PM
6 PM TO 9 PM

FIG. 15 - AUTOMOBILE ARRIVALS AT U. B.
WEDNESDAY

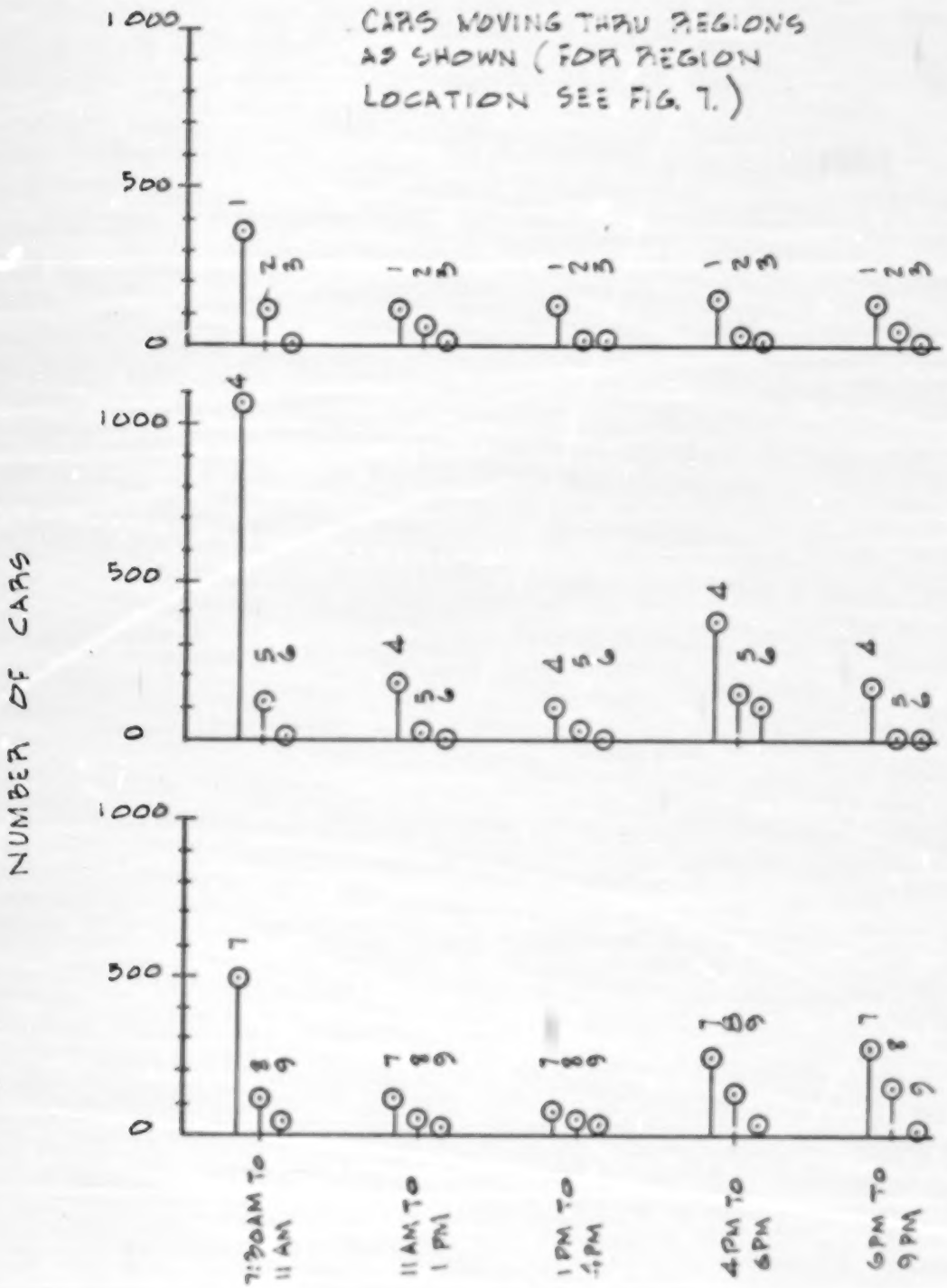
CARS MOVING THRU REGIONS AS SHOWN (FOR REGION LOCATION SEE FIG. 7.)
NUMBER OF CARS
1000
500
0
7:30AM TO 11 AM
11 AM TO 1 PM
1 PM TO 4 PM
4 PM TO 6 PM
6 PM TO 9 PM

FIG. 16 - AUTOMOBILE ARRIVALS AT U. B.
THURSDAY

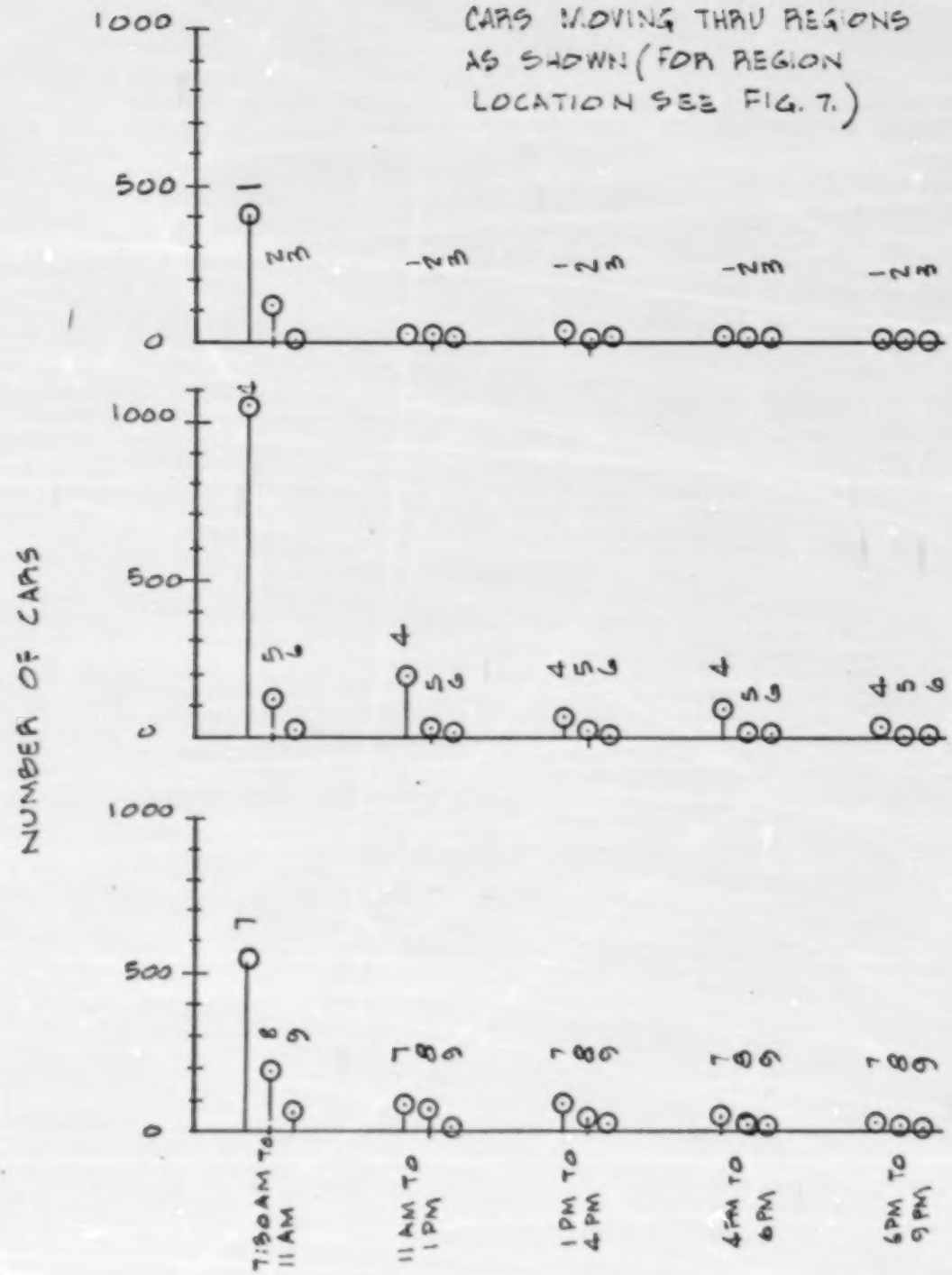

FIG. 17 - AUTOMOBILE ARRIVALS AT U. B.
FRIDAY

TABLE 6. - FULL AND PART-TIME STUDENTS
FROM AREAS WITHIN BRIDGEPORT*

AREA	FULL-TIME		PART-TIME	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
1	97	78	45	90
2	204	195	180	248
3	224	263	90	113
4	293	293	248	135
5	39	39	23	23
6	78	49	0	23
7	97	93	23	23
8	58	49	113	68

* Figures shown are extrapolated from the survey and exclude those individuals who do not leave the campus at least once a week.

CONCLUSIONS

A practical method was developed and evaluated for acquiring statistics related to travel characteristics for an educational institute within the HECUS organization. The results and techniques developed for this study can be related to other educational institutions.

Two main areas of interest were investigated. The first related to movement to and from special events while the second considered the transit movement for the total university population. A computer program was designed to consider this last area.

Certain conclusions can be drawn from the study and may be stated as follows:

1) The technique of canvassing 10% of the full time faculty through a random selection, and then randomly selecting the students of these faculty, appear to give results with a fair amount of confidence if 7% of the institute's population participate.
2) Reasonably good comparison between 5% and 7% of the university population has also occurred.
3) Special event surveys indicated that approximately 60% of the attendees come from the university population. Also, over 50% come from Bridgeport.
4) Most persons attending special events with the auto, do not come by themselves.
5) A Northern corridor leading away from the University supplies the greatest traveling population.
6) It is possible, through the designed computer program, to track movement to and from the institution covering given time periods.

Finally, the authors would like to suggest certain ideas for additional use of the developed computer program. They are:

- analyze the nature of driving population
- initiate an integrated transportation system of several surrounding educational institutes
- provide service to regions supplying the most students to improve enrollment
- help solve parking problems at institutions
- determine the flow of traffic on adjacent streets surrounding an institute which could then be used in solving traffic problems
- attract other modes of travel besides one passenger autos
- determine specific areas for possible advertisement for special events
- determine areas supplying a small quantity of students and develope ways to attract these students

REFERENCES

1. Boyce, D. E., "Assessing Impact of Urban Transportation", Transportation Engineering Journal of ASCE, August, 1972, pp. 645-662

2. Gould, J. M., "Innovations In Mass Transit", Transportation Engineering Journal of ASCE, December, 1967, pp. 163-188.

3. Taylor, S. F. and Petulla, L. W., "Urban Mass Transportation: Review and Analysis", Transportation Engineering Journal of ASCE, May, 1970, pp. 175-183.

4. Notess, C. B. and Paaswell, R. E., "Demand Activated Transportation for the Elderly", Transportation Engineering Journal of ASCE, November, 1972, pp. 807-821.

5. Carp, F. M. "Transportation and Retirement", Transportation Engineering Journal of ASCE, November, 1972, pp. 787-798.

6. Ashford, N. and Holloway, F. H., "Variations of Urban Travel Characteristics With Age", Transportation Engineering Journal of ASCE, August, 1972, pp. 715-732.

7. Saltzman, A. and Kidder, A. E., Sowell, F. V., "Transportation Research for Community Objectives", Transportation Engineering Journal of ASCE, November, 1972, pp. 855-863.

8. Notess, C. B., "Shopping and Work Trips in the Black Ghetto", Journal of the Urban Planning and Development Division of ASCE, July, 1972, pp. 71-83.

9. Guyton, J. W. and Reed, G. L., "Planning for Campus Traffic and Parking", Transportation Engineering Journal of ASCE, February, 1971, pp. 63-82.

Note: ASCE = American Society of Civil Engineers